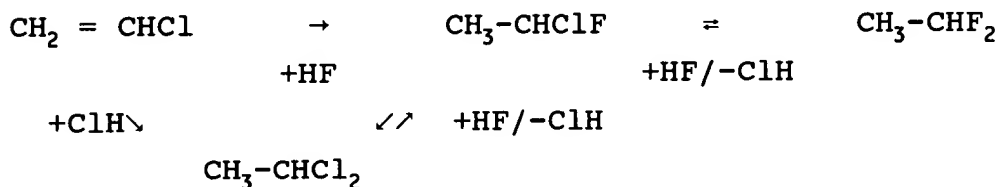


U.S. Patent 5,008,474 to Walraevens considered together with International Publication WO 89/12614 by Rao. Applicants respectfully traverse the Examiner's rejection, and request reconsideration.

The invention concerns a process for the manufacture of 1-chloro-1-fluoroethane, 1,1-difluoroethane, or mixtures thereof by reaction between hydrogen fluoride and vinyl chloride in a liquid phase. The several related chemical reactions are as follows:

# HEAVIES

↗ (+HF)



As described in the specification at page 1, lines 27 to 33, a major problem in this reaction concerns the formation of "heavies" in high quantities, principally comprising fluorinated oligomers of vinyl chloride. The present invention solves this problem by conducting the reaction in an organic solvent consisting of at least one saturated halogen-containing hydrocarbon.

Walraevens describes a process for the manufacture of 1-chloro-1,1-difluoroethane from vinylidene chloride by

reaction with hydrogen fluoride (column 1, lines 14 to 16). By-products of this reaction include 1,1,1-trifluoroethane as well as 1,1-dichloro-1-fluoroethane, vinylidene chloride, and 1,1,1-trichloroethane (see column 4, lines 5 to 8). The entire disclosure of Walraevens is concerned with a process using **vinylidene chloride** as the starting material. There is no description or suggestion in Walraevens that any other starting material could be used, with a reasonable likelihood of success. In sharp contrast to Walraevens et al., the present process uses a different starting material, namely vinyl chloride ( $\text{CH}_2=\text{CHCl}$ ) instead of vinylidene chloride ( $\text{CH}_2=\text{CCl}_2$ ), which obviously lead to different products.

The process set forth in claim 11 above, further differs from the disclosure of Walraevens et al. in the use of a different organic solvent, namely at least one saturated halogen-containing hydrocarbon selected from the group consisting of 1-chloro-1-fluoroethane, 1,1-difluoroethane, 1,1-dichloroethane, and compounds containing from 4 to 8 carbon atoms. In sharp contrast, the Walraevens disclosure requires a liquid medium containing 1,1-dichloro-1-fluoroethane.

The Examiner asserts that the process of the present invention is obvious because:

- (1) vinyl chloride could be considered **analogous** to vinylidene chloride;
- (2) the products obtained by the instantly claimed process (1-chloro-1-fluoroethane and/or 1,1-difluoroethane) would be **consistent** with the product obtained by Walraevens (1-chloro-1,1-difluoroethane); and
- (3) the motivation of using vinyl chloride in the Walraevens process would be derived from an expectation of obtaining a known useful product.

Applicants vigorously traverse the Examiner's reasoning, and request reconsideration. Applicants respectfully submit that the Examiner's rejection is based on pure speculation, unfounded assumptions, and hindsight reconstruction.

As to the "analogy" of the starting materials, beyond the structural analogy between vinyl chloride and vinylidene chloride, applicants note that these materials have well known **very different** reactivities. Vinyl chloride is far more reactive than vinylidene chloride, and thus has a far greater tendency than vinylidene chloride to form "heavies" by oligomerization.

Rao discloses the structural analogy between vinyl chloride and vinylidene chloride. **Rao contains no examples using vinyl chlorid or vinylidene chloride as a starting**

**mat rial.** No conclusion concerning their respective behavior in the Rao process can thus be gleaned from the published application and, fortiori, no conclusion concerning the alleged analogy between these two compounds can be reached.

As to the alleged consistency of the reaction results, applicants respectfully submit that quite different chemical equilibria are involved in the two processes. In particular, in the presently claimed process, the parallel reactions of vinyl chloride and 1-chloro-1-fluoroethane with ClH produced, leading to 1,1-dichloroethane, are far more important than similar reactions of vinylidene chloride and 1,1-dichloro-1-fluoroethane with ClH, **which would lead to 1,1,1-trichloroethane** in the Walraevens process.

To further establish the very different reactivities of vinyl chloride and vinylidene chloride, applicants have conducted the following tests, using vinylidene chloride as starting material, in conditions similar to those of Examples 1 and 4 at pages 9 to 11 of applicants' specification.

In the test carried out with vinyl chloride (VC) in the absence of catalyst, reported in Example 1 of the present application, more than 95% of VC was converted after 1 hour of reaction. Selectivities were 59% of 1-chloro-1-fluoroethane (151a), less than 1% of 1,1-dichloroethane (152a), 4% of 1,1-dichloroethane (11DCE) and 35% of heavies.

It can be added that a complete VC conversion is obtained after 2 hours.

In a test carried out with vinylidene chloride (VC2) in conditions similar to those of Example 1, 6 hours of reaction were needed to reach a 99% VC2 conversion. Selectivities were 91% of 1,1-dichloro-1-fluoroethane and only 5% of heavies.

In the test carried out with vinyl chloride (VC) in the presence of a catalyst, reported in Example 4 of the present application, selectivities were 12% of 1-chloro-1-fluoroethane (151a), 4% of 1,1-dichloroethane (152a), 59% of 1,1-dichloroethane (11DCE) and 25% of heavies.

In a test carried out with vinylidene chloride (VC2) in conditions similar to those of Example 4, selectivities were 54% of 1,1-dichloro-1-fluoroethane, 41% of 1-chloro-1,1-difluoroethane and only 0.7% of heavies. Example 1(R) of Walraevens et al. (column 5, lines 15-64) reports very similar results obtained in analogous conditions.

The comparison of these additional examples with Examples 1 and 4 of the present application clearly evidences that, in similar conditions:

- (1) vinyl chloride is highly more reactive than vinylidene chloride;

- (2) more "heavies" are formed in a system starting from vinyl chloride than from vinylidene chloride;
- (3) parallel reactions with ClH are far more important in a system starting from vinyl chloride (production of 1,1-dichloroethane) than in the system starting from vinylidene chloride (very limited formation of 1,1,1-trichloroethane).

Applicants therefore respectfully submit that it is clear that the reactivity of vinyl chlorides is **not** analogous to the reactivity of vinylidene chloride, and that the products obtained when vinylidene chloride is replaced by vinyl chloride in a given process are not necessarily those in which a fluorine group replaces one chloro group, as asserted by the Examiner. Applicants respectfully submit that in view of the above experiments, there is **no reasonable expectation** of obtaining a known useful product with high selectivity when replacing the vinylidene chloride starting material by vinyl chloride, and thus a person of ordinary skill in the art would have had **no motivation** to make the modifications suggested by the Examiner. Furthermore, the process of claim 11, using solvents not even disclosed by Walraevens, could not possibly have been obvious in view of the Walraevens disclosure.

Applicants respectfully submit that the Examiner's reliance on the holding in In re Durden is inapposite. In Durden the issue was patentability of making a novel chemical compound using a process which, appellants admitted, was obvious absent the novelty of the starting material in the final product. The Federal Circuit held that an otherwise old process with a predictable outcome is not necessarily unobvious simply because the starting material in the final product produced by the process are novel and unobvious. In the present application, applicants respectfully submit that their process is both new and unobvious when considered with respect to Walraevens process, for the reasons described above. Accordingly, applicants respectfully submit that the Examiner's reliance on Durden is inapposite.

Applicants therefore respectfully request the Examiner to reconsider and withdraw the rejection of the claims under Section 103.

For the reasons discussed, and in view of the above amendments, applicants respectfully submit that their

application is now in condition for allowance. The Examiner is respectfully requested to call the undersigned attorney if any minor matter remains.

Respectfully submitted,



John W. Schneller  
(Registration No. 26,031)  
SPENCER, FRANK & SCHNEIDER  
Suite 300 East  
1100 New York Avenue, N.W.  
Washington, D.C. 20005-3955  
Telephone: (202) 414-4000  
Telefax : (202) 414-4040

JWS:nm